Problem Statement:

Flight delays due to adverse weather cause significant profit losses and customer dissatisfaction; predicting flight schedule disruptions due to weather conditions will allow airlines to act proactively in mitigating these consequences.

Objective:

Our goal is to develop an accurate predictive model that improves upon existing models for predicting flight delays by leveraging available weather and flight data. Ideally, this will be a sophisticated model that would prove useful to the airline industry today.

Background:

Flight delays are a major concern in the aviation industry, as even a single flight delay can have a domino effect on subsequent flights that leads to dissatisfaction with customers and profit loss for airlines. When flights are delayed, customers can miss connecting flights as well as important events that they're traveling for. This could lead to decreased customer loyalty as well as increased allocation of resources to customer service. When a flight is delayed, customers are moved to different flights and could potentially request a refund for their airfare, causing the airline to lose money through opportunity cost as well as actual cost. Developing models that use weather data and flight information to create precise predictions of delay occurrences and durations would allow airlines to be better prepared for weather-related delays, allowing for increased customer satisfaction and decreased profit losses.

Weather conditions are a critical factor in contributing to flight delays. According to OPSNET standard "delay by cause" reports, weather caused 74.27% of flight delays greater than 15 minutes between June 2017 and May 2023 (2). Adverse weather makes up a significant percentage of causes for flight delays, and the resulting profit losses are staggering. According to a study conducted by masFlight, weather-related disruptions between December 2013 and February 2014 cost airlines $5.3 billion in lost passenger activity and $500 million in operating costs–a profit loss of $5.8 billion in only one year's time (1). Profit losses due to weather-related flight delays could be mitigated by optimizing operations such as scheduling and resource allocation. For example, weather conditions that require moderate to aggressive management will require flights to be scheduled with new flight plans that don't intersect with the weather-impacted areas (2). Having models that accurately anticipate adverse weather conditions can allow airlines to have a head start on this scheduling process, reducing delays and improving cost-effectiveness. Further, airlines could act proactively in managing customer service in order to improve loyalty and satisfaction.

Building an accurate, robust predictive model for weather-related delays would make a significant difference in the ability to anticipate and handle the consequences of such delays. With adverse weather making up such a large percentage of flight delays, any improvement in

predicting delays would make a remarkable impact on the industry, improving the experience of customers as well as preventing profit losses in the industry.

Sources:

1. https://www.tomorrow.io/blog/4-ways-traditional-weather-forecasts-negatively-impact-airlines-airports/
2. https://www.faa.gov/nextgen/programs/weather/faq